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TRENDS IN WAGE AND INCOME DISTRIBUTION UNDER GORBACHEV
Analysis of New Soviet Data

Michael V. Alexeev and Clifford G. Gaddy

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TRENDS IN WAGE AND INCOME DISTRIBUTION UNDER GORBACHEV: ANALYSIS OF NEW SOVIET DATA

MICHAEL ALEXEEV, *George Mason University*
CLIFFORD GADDY, *Duke University*

SUMMARY

Deputies to the USSR Congress of People's Deputies in Moscow in 1989—the first real Soviet parliament since 1918—expressed strong interest in issues of welfare and poverty. As a result, the country's national statistics agency released unprecedented new series on the size distribution of wages and income in the country, including the distributions by republics.

This paper applies a simple nonparametric statistical estimation technique based on the Kolmogorov–Smirnov test to fit the new Soviet data to a lognormal distribution, thus making it possible to estimate Gini coefficients for wages and incomes nationally and by republics.

Analysis of the estimates shows that wage inequality in the Soviet Union has increased during the Gorbachev era, and that both wage and income inequality are higher in the poorer, Southern republics of the USSR than in the North. The paper also concludes that illegal (unreported) private income exacerbates these same trends.

1. INTRODUCTION

When the new and relatively democratically elected Soviet parliament, the Congress of People's Deputies, first convened in Moscow in May 1989, one area which quickly attracted strong attention was the complex of issues relating to welfare, poverty, and economic equity. Public discussion of the major discrepancies in welfare levels in the country had previously been virtually taboo. But as a result of the interest in these issues expressed by the deputies in the new parliament, the official statistics agency of the USSR, Goskomstat, soon released several new statistical series on the personal money income of Soviet citizens and on income distribution, including the distributions by republics. These new series came not long after the publication of similar data on wages in Goskomstat's handbook on labor statistics, *Trud v SSSR* [1988].[1] Admittedly, the newly published data on incomes and wages suffer from some of the same problems of coverage and definition as previous Soviet data.[2] Still, they are not only the best available data we have on Soviet income distribution; they in some cases are the first time we have such data since the 1920s, and their analysis has important implications for understanding trends in a Soviet society in the midst of rapid social and economic change.

The primary purpose of this paper is to use these new data to derive inequality measures (Gini coefficients) for both wage and income distribution in the USSR over time and across republics. By so doing, not only can we for the first time study trends in inequality during the Gorbachev era. We also are finally able to make some definite statements regarding issues of wage and income distribution by republic.

The new data are reproduced for reference in Tables 1.1—1.4 on the following pages. Section 2 briefly reviews some conceptual issues regarding the measurement of inequality and the particular problems encountered with the new Soviet data. This section also presents the technique we used to estimate Gini coefficients for the USSR and the republics. The following sections discuss the results of estimation as they relate to wage and income inequality in the USSR as a whole since 1956 (Section 3) and wage and income inequality within the Soviet republics (Section 4). Finally, Section 5 speculates how illegal income might affect income inequality and then uses the results from a survey of Soviet emigres to the United States to test the

[1] For convenience of exposition, in this paper we use the English "wages" to refer to the Russian *zarabotnaya plata*, which includes not only wages of hourly and piece-rate workers [*rabochiye*] but also the earnings of salaried employees [*sluzhashchiye*]. "Income" [*dokhod*] includes both wage earnings and (legal) non-wage income.

[2] Many of the problems of Soviet data have been identified in the extensive surveys of wage and income inequality in the USSR by BERGSON [1984] and CHAPMAN [1977, 1989]. CHAPMAN [1977] deals especially with the ambiguities of Soviet wage data. Note 1 of our Appendix shows that the problems with household income data are perhaps even more serious.

impact of illegal income.[3] Appendices provide more detail on some technical issues relating to data and estimation.[4]

TABLE 1.1 Distribution of Soviet Workers and Employees, 1956–1986, by Wage and Salary Levels (% in each earnings interval)

Rubles earned per month	March 1956	April 1968	March 1972	April 1976	March 1981	March 1986
Under 80	71.0	32.7	23.6	15.2	6.4	4.9
80-100	13.2	21.3	18.5	14.6	13.6	11.3
100-120	6.6	15.1	14.7	13.2	12.3	10.3
120-140	3.6	10.7	12.1	12.9	12.5	11.0
140-160	2.0	7.3	9.5	11.6	11.7	11.4
160-200	1.9	7.4	11.9	16.2	19.2	18.4
200-250	1.2	3.1	5.6	9.0	12.5	15.3
250-300		1.3	2.1	3.8	5.6	7.7
Over 300	0.4	1.1	2.0	3.4	6.2	9.6

SOURCE: Figures given in *Trud v SSSR* [1988, p. 146] have been adjusted by excluding part-time workers and students (never more than 1.2% in any year) and recomputing percentages for full-time workers only.

[3] This paper does not discuss two other major factors in the distribution of real income in the USSR—namely, state subsidies and privileges. While we recognize the importance of these factors, the lack of data makes careful analysis nearly impossible. Since privileges are normally bestowed on elite high-income groups (see MATTHEWS 1978), we can predict that adding privileges to official income would unambiguously increase inequality. However, it is all but impossible to quantify this effect. The case of state subsidies is more complicated. BERGSON [1984, p. 1075] suggests that, on balance, subsidies tend to even out distribution of income. ALEXEEV [1990a] and a recent Goskomstat survey [1990] present some evidence in support of this conjecture. But many Soviet economists (e.g., RUTGAYZER et al. [1989, p. 61] maintain the contrary, especially with respect to food subsidies. It is to be noted, however, that even if we had access to complete official Soviet data, we might not be able to resolve this problem, owing to the possibility of "purchasing" state subsidies through the second economy [ALEXEEV 1988].

[4] One of the notes in the Appendix (Note 6) also includes prelimary analysis of new Soviet wage distribution data by age and sex. These are topics that extend beyond the main themes of the body of the text. However, since the data represent previously unavailable information and are amenable to same sort of estimation made here on national and republican wage data, we do present results of estimation and some very brief comments for reference.

TABLE 1.2 Distribution of Soviet Workers and Employees, 1981 and 1986, by Wage and Salary Levels, by Republic (% in each earnings interval)

		Rubles earned per month						
		Under 80	80–120	120–160	160–200	200–250	250–300	Over 300
USSR	1981	6.4	26.0	24.2	19.2	12.5	5.6	6.2
	1986	4.9	21.7	22.5	15.4	18.3	7.7	9.6
RSFSR	1981	4.8	23.1	23.7	20.1	13.9	6.4	7.9
	1986	3.7	18.5	21.2	19.2	16.5	8.8	12.0
Ukraine	1981	7.2	29.6	26.3	18.4	10.7	4.1	3.7
	1986	5.5	24.9	24.9	18.5	14.1	6.3	5.9
Belorussia	1981	7.8	28.2	26.9	19.5	11.3	4.0	2.3
	1986	5.4	22.6	24.6	20.3	15.9	6.9	4.4
Uzbekistan	1981	10.9	32.3	24.2	16.4	8.8	3.7	3.6
	1986	8.6	29.8	25.9	15.1	11.1	4.8	4.6
Kazakhstan	1981	8.1	29.3	23.2	17.3	11.1	5.2	5.9
	1986	5.7	25.1	22.9	16.6	13.9	7.1	8.7
Georgia	1981	11.2	35.8	22.6	14.8	7.6	3.7	4.3
	1986	9.2	32.0	23.9	12.7	9.6	5.0	7.6
Azerbaijan	1981	13.0	36.2	21.4	14.2	7.5	3.6	4.2
	1986	10.7	34.6	22.2	12.7	9.3	4.6	5.9
Lithuania	1981	6.6	23.8	24.5	21.0	14.3	5.8	4.1
	1986	4.8	19.7	21.5	19.9	18.0	8.9	7.2
Moldavia	1981	10.4	34.6	26.8	15.7	8.0	2.7	1.8
	1986	7.6	29.5	26.0	17.6	11.3	4.7	3.3
Latvia	1981	6.3	22.9	24.0	20.9	14.2	6.4	5.4
	1986	4.8	18.5	21.4	19.7	17.1	9.3	9.1
Kirgizia	1981	9.9	33.5	24.0	16.2	9.4	3.7	3.2
	1986	7.5	31.0	24.2	15.5	11.6	5.4	4.9
Tadzhikistan	1981	11.8	31.0	23.9	16.7	10.0	3.7	2.8
	1986	10.5	28.4	23.3	16.2	11.9	5.3	4.4
Armenia	1981	9.5	29.2	22.4	16.7	10.2	5.2	6.7
	1986	5.8	27.3	22.5	15.0	12.7	6.6	10.1
Turkmenistan	1981	5.9	25.4	21.6	18.8	13.3	7.0	8.1
	1986	4.7	23.4	22.5	16.8	14.9	7.9	9.9
Estonia	1981	4.7	19.0	21.9	21.1	16.8	8.5	8.0
	1986	3.7	15.4	19.4	19.4	18.2	11.3	12.6

SOURCE: Figures given in *Trud v SSSR* [1988, p. 188] have been adjusted by excluding part-time workers and students and recomputing percentages for full-time workers only. Figures are for March of each year.

TABLE 1.3 Distribution of USSR Population by Household Income Per Capita—1980, 1985, 1988 (% in each income interval)

Rubles per month	1980	1985	1988
Under 50	7.3	4.3	2.9
50-75	18.5	13.6	9.7
75-100	23.2	19.8	15.7
100-125	19.5	19.3	17.6
125-150	13.2	15.0	15.7
150-175	8.2	10.4	12.2
175-200	4.7	6.7	9.0
200-250	4.1	6.9	10.1
Over 250	1.3	4.0	7.1

SOURCE: Figures from the USSR State Committee on Statistics [*Goskomstat*] presented in *Ekonomicheskaya gazeta*, No. 25 (June), 1989, p. 11.

TABLE 1.4 Distribution of USSR Population by Household Income Per Capita in 1988, by Republic (% in each income interval)

	Rubles per month				
	Under 75	75-100	100-150	150-200	Over 200
USSR	12.6	15.7	33.3	21.2	17.2
RSFSR	6.3	13.1	34.0	24.6	22.0
Ukraine	8.1	16.8	38.5	22.4	14.2
Belorussia	5.0	12.9	36.8	25.8	19.5
Uzbekistan	44.7	23.9	22.2	6.4	2.8
Kazakhstan	15.9	19.3	33.7	18.1	13.0
Georgia	16.3	17.4	31.6	18.1	16.6
Azerbaijan	33.3	22.2	27.3	10.9	6.3
Lithuania	3.6	10.7	34.6	27.1	24.0
Moldavia	13.0	19.8	37.3	18.9	11.0
Latvia	3.2	9.5	31.8	27.2	28.3
Kirgizia	37.1	23.1	26.0	9.2	4.6
Tadzhikistan	58.6	20.7	15.5	3.8	1.4
Armenia	18.1	21.5	34.7	16.2	9.5
Turkmenistan	36.6	23.0	25.8	9.4	5.2
Estonia	3.9	9.0	28.0	25.5	33.6

SOURCE: Figures from the USSR State Committee on Statistics [*Goskomstat*] presented in *Ekonomicheskaya gazeta*, No. 25 (June), 1989, p. 11.

2. MEASUREMENT OF INEQUALITY

It has long been known, beginning with the work of ATKINSON [1970], that any ranking of countries (or other units) on the basis of income inequality will depend on the particular measure of inequality used in the analysis. Different measures of inequality highlight different facets of the same reality, and they may also lead to different rankings of the same countries. In this sense, there is no single "perfect" measure of inequality. However, following ALLISON [1978], we would argue that any adequate inequality index should satisfy certain basic criteria, including *scale invariance* and the *principle of transfers*.[5] Among the relatively few measures of inequality that satisfy both of these criteria, we chose to employ the most popular: the Gini coefficient.[6]

Normally, computation of a Gini coefficient from income distribution data is a relatively simple matter. However, in the present case a number of technical problems had to be resolved before the data series presented in Tables 1.1–1.4 could be used to compute Gini coefficients for Soviet wage and income distribution. Most of these problems stem from the fact that the official Soviet data are grouped (presented as percentages of total units falling into various income intervals) and that they are censored (that is, the uppermost income ranges are open–ended).

An example of the difficulties caused by censoring can be seen in the data on the size distribution of Soviet wages for 1986 (the right–hand column in Table 1.1). There we see that 9.6% of wage–earners fell into the interval labeled "Over 300 rubles/month." But even though we know that these 9.6% made more than 300 rubles a month, we know neither the upper limit of that range nor how the 9.6% are distributed within the upper interval. Clearly, the Gini coefficient for the entire distribution could differ quite substantially depending on our assumptions regarding this open–ended interval.

A somewhat different problem arises for the lowermost intervals. Strictly speaking, the lowest interval of neither the wage nor the income distribution is open–ended, of course, since wages and incomes must be some positive number. Still, the exact level of the threshold is unknown. For the official Soviet data on wage earnings, this problem of accurately determining the minimum threshold of the distribution is especially important. Once again, look at Table 1.1. In the two

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[5] Scale invariance requires that multiplying everyone's income by a constant does not affect the measure of inequality. The principle of transfers states that measures of inequality must increase when income is transferred from a poorer person to a richer one. Decile ratios, so often used to measure income inequality in the USSR (see BERGSON [1984] for references), fail to satisfy the principle of transfers. (The decile ratio—P90/P10—is defined as the ratio of the cutoff point for the 90th income percentile to that of the 10th percentile.)

[6] See Appendix, Note 2, for the definition and computation of the Gini coefficient. We should also remind the reader of one well–known drawback of the Gini coefficient: the Gini can only provide an unambiguous ranking of alternative income distributions if the underlying Lorenz curves do not intersect. Since we cannot guarantee nonintersecting Lorenz curves for any of our cases, this shortcoming should be kept in mind when interpreting the results of this paper.

earliest years, 1956 and 1968, no fewer than 71.0% and 32.7% of wage earners, respectively, fell into the "Under 80" (rubles/month) category. Table 1.4 shows that the problem is also quite severe in the case of total household income per capita for some republics. For instance, 58.6% of residents of Tadzhikistan were in the "Under 50" range.

There are several techniques for dealing with the problem of grouped and censored data. The one we have chosen is to make some assumption about the underlying distribution of earnings from which the grouped data are drawn. Traditionally, estimations of income distribution have tended to use relatively simple distributions such as the lognormal distribution or the Pareto distribution. Although Western studies have suggested other, more flexible forms, we decided to assume a lognormal distribution for both Soviet wages and total income.[7] For our purposes the lognormal is computationally easier, and as CHAPMAN [1977] indicates, it also seems to be the form preferred by Soviet writers.

A lognormal distribution is completely characterized by two parameters: the mean and the variance. In our case, however, because the minima of the wage and income distributions are above zero, we must determine one additional parameter, namely the displacement of the entire distribution to the right. If we label this rightward displacement of the distribution from zero the minimum, our problem is to find the mean, variance, and minimum of the lognormal distribution which best fit the available data. The technique we chose for estimation was based on minimizing the Kolmogorov–Smirnov statistic for goodness–of–fit between two distributions. This method is by far the simplest way of determining the parameters of the lognormal distribution with the best fit to the grouped censored data. Although there are other techniques which could be used for our task, all are much more difficult to implement and selected comparisons which we made indicated that they did not appreciably alter the estimates.[8]

In principle, the minimum Kolmogorov–Smirnov estimator can determine all three parameters of the displaced lognormal distribution. This is the approach we used in an initial estimation. If the Soviet wage and income distributions were exactly lognormal and if the data were correctly measured and not subject to rounding error, this would be adequate. However, given that neither of these conditions are true, we decided also to make further estimations using some of the additional information available from Soviet sources to restrict the parameters of the lognormal curve.

For instance, the annual Soviet statistical handbook [*Narodnoye khozyaystvo (Narkhoz)*] presents the mean monthly wage earnings for the same years for which

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[7] MCDONALD and RANSOM [1979], who sum up much of the discussion on the issue of the "best" functional form, find for instance that the Singh–Maddala distribution seems to fit U.S. income data better than the Pareto or lognormal.

[8] See Appendix, Note 3, for a description of the minimum Kolmogorov–Smirnov estimator. AITCHISON and BROWN [1957, pp. 51 and 94] describe some alternative techniques for estimating the parameters of a lognormal distribution from grouped data.

we have the size distribution data.[9] Also, since we know the legal minimum monthly wage in the Soviet Union, we have information which should allow us to determine exogenously the lower threshold of the distribution.[10]

In all, in case of the wage distribution, we made four separate estimations on the data for each year to fit a lognormal distribution to the original data as presented in Tables 1.1 and 1.2. One estimation used only the grouped data reported, without any restrictions imposed on the mean and minimum of the distribution, and allowed the estimator to determine the best-fitting mean, variance, and minimum. A second estimation assumed a minimum, but allowed the estimator to determine the mean and variance. A third assumed a mean, but allowed the estimator to determine the minimum and variance. Finally, a fourth estimation used both the assumed mean and minimum.

For total income data—Tables 1.3 and 1.4—the problem was somewhat different. For both the data for the USSR and the republics, we made two sets of estimations. For the USSR as a whole, since there is information on the mean per capita income, we made one estimate using that mean with an assumed minimum and a second estimate with no assumptions about the minimum.[11] In the case of the republican data, however, the Soviets have never published any figures for mean per capita income. Consequently, our first estimate made no assumptions about the mean or minimum, and the second used an assumed minimum and allowed the estimator to determine the mean.

Once we obtained the mean, variance, and minimum of the best-fitting lognormal distribution for each set of data, a simple formula allowed us to compute the Gini coefficient for a lognormal distribution with these parameters.[12] The results of estimation are presented in Tables 2.1–2.4 below. In the following sections we discuss the implications of these estimates for wage and income inequality for the USSR as a whole (Section 3) and for the republics (Section 4).

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[9] See Appendix, Note 4, for sources of data (and problems regarding these data) on mean monthly wage and salary earnings.

[10] We discuss in Appendix, Note 5, how we used information on the legally prescribed minimum wage in the Soviet Union to make some assumptions about the actual minimum.

[11] According to *Ekonomicheskaya gazeta*, No. 25, 1989, mean per capita income for 1980, 1985, and 1988 was 112, 127, and 143 rubles/month, respectively. *Pravda* of January 28, 1990, gives a figure of 147 rubles/month for 1988. Our calculations are based on values of 112, 127, and 147.

[12] In fact, the Gini coefficient of a lognormal income distribution is completely determined by the variance alone. The formula is:

$$\text{Gini} = 2 \cdot \Phi\left((L/2)^{1/2}\right) - 1$$

where $\Phi(\cdot)$ is the cumulative distribution function for a standard normal variable and L is the variance of the lognormal distribution.

TABLE 2.1 Estimates of the Gini Coefficient for the USSR Based on a Lognormal Distribution of Wage Earnings—1956, 1968, 1972, 1976, 1981, 1986

	(1) Mean and minimum free			(2) Minimum fixed; mean free			(3) Mean fixed; minimum free			(4) Both mean and minimum fixed		
	Gini	Mean	Min.	Gini	Mean	Min.	Gini	Mean	Min.	Gini	Mean	Min.
1956	.197	73	27	.175	71	17	.200	73.5	29	.177	73.5	17
1968	.159	109	26	.235	111	54	.192	111.4	41	.224	111.4	54
1972	.138	124	8	.240	130	56	.200	129.1	43	.228	129.1	56
1976	.130	144	2	.235	156	58	.192	150.5	43	.226	150.5	58
1981	.143	165	20	.224	176	64.5	.197	171.6	55	.217	171.6	64.5
1986	.146	182	17	.238	198	70	.202	194.2	55	.233	194.2	70

NOTE: A lognormal curve was fitted to the data in Table 1.1 by a minimum Kolmogorov-Smirnov estimator. The four estimates differ in the number of parameter values supplied exogeneously. Estimate (1) uses neither an exogenous mean or minimum wage; estimate (2) uses an exogenous minimum; estimate (3) uses an exogeneous mean; and estimate (4) uses both an exogenous mean and minimum.

TABLE 2.2 Estimates of the Gini Coefficient for the USSR and Republics Based on a Lognormal Distribution of Wage Earnings—1981 and 1986

	(1) (Mean fixed; minimum free)			(2) (Mean and minimum fixed)		
1981	Gini	Mean	Min.	Gini	Mean	Min.
USSR	.172	171.5	45	.217	171.5	64.5
RSFSR	.177	180.6	50	.207	180.6	64.5
Ukraine	.159	157.1	41	.214	157.1	64.5
Belorussia	.122	152.3	15	.197	152.3	64.5
Uzbekistan	.224	157.9	60	.245	157.9	64.5
Kazakhstan	.205	169.4	55	.240	169.4	64.5
Georgia	.207	147.5	54	.238	147.5	64.5
Azerbaijan	.233	151.4	59	.258	151.4	64.5
Lithuania	.141	168.6	29	.200	168.6	64.5
Moldavia	.141	139.9	30	.212	139.9	64.5
Latvia	.151	174.0	35	.205	174.0	64.5
Kirgizia	.172	149.6	43	.228	149.6	64.5
Tadzhikistan	.146	147.2	25	.226	147.2	64.5
Armenia	.207	165.4	51	.240	165.4	64.5
Turkmenistan	.177	178.0	41	.212	178.0	64.5
Estonia	.164	191.6	45	.200	191.6	64.5
1986	Gini	Mean	Min.	Gini	Mean	Min.
USSR	.195	194.0	56	.228	194.0	70
RSFSR	.195	205.9	59	.221	205.9	70
Ukraine	.182	177.5	54	.233	177.5	70
Belorussia	.167	178.5	51	.219	178.5	70
Uzbekistan	.190	165.4	51	.256	165.4	70
Kazakhstan	.214	190.9	61	.254	190.9	70
Georgia	.242	169.7	61	.273	169.7	70
Azerbaijan	.233	162.0	59	.280	162.0	70
Lithuania	.182	193.3	58	.209	193.3	70
Moldavia	.170	160.6	46	.240	160.6	70
Latvia	.185	199.8	57	.221	199.8	70
Kirgizia	.195	165.3	53	.254	165.3	70
Tadzhikistan	.167	160.8	35	.256	160.8	70
Armenia	.212	183.3	55	.251	183.3	70
Turkmenistan	.200	192.5	56	.238	192.5	70
Estonia	.228	219.3	80	.207	219.3	70

NOTE: A lognormal curve was fitted to the data in Table 1.2 by a minimum Kolmogorov-Smirnov estimator. See note to Table 2.1 for difference in estimates.

TABLE 2.3 Estimates of the Gini Coefficient for the USSR Based on a Lognormal Distribution of per Capita Total Income—1980, 1985, and 1988

	(1) (Mean and minimum free)			(2) (Minimum fixed; mean free)		
	Gini	Mean	Min.	Gini	Mean	Min.
1980	.128	111	1	.146	112	12.6
1985	.130	128	1	.146	129	13.8
1988	.130	145	1	.146	146	14.4

NOTE: A lognormal curve was fitted to the data in Table 1.3 by a minimum Kolmogorov-Smirnov estimator. See note to Table 2.1 for difference in estimates.

TABLE 2.4 Estimates of the Gini Coefficient for the USSR and Republics Based on a Lognormal Distribution of per Capita Total Income—1988

	(1) (Mean and minimum free)			(2) (Minimum fixed; mean free)		
	Gini	Mean	Min.	Gini	Mean	Min.
USSR	.130	145	1	.146	146	14.4
RSFSR	.120	158	2	.133	160	14.4
Ukraine	.111	142	1	.125	142	14.4
Belorussia	.114	155	6	.122	156	14.4
Uzbekistan	.143	90	9	.154	91	14.4
Kazakhstan	.130	133	2	.146	134	14.4
Georgia	.141	140	2	.157	141	14.4
Azerbaijan	.143	106	4	.159	107	14.4
Lithuania	.111	164	3	.122	165	14.4
Moldavia	.117	131	1	.133	132	14.4
Latvia	.114	172	3	.125	174	14.4
Kirgizia	.136	99	1	.157	101	14.4
Tadzhikistan	.151	77	11	.159	78	14.4
Armenia	.125	124	2	.141	125	14.4
Turkmenistan	.146	101	7	.159	102	14.4
Estonia	.128	184	4	.138	186	14.4

NOTE: A lognormal curve was fitted to the data in Table 1.4 by a minimum Kolmogorov-Smirnov estimator. See note to Table 2.1 for difference in estimates.

3. WAGE AND INCOME INEQUALITY FOR THE ENTIRE USSR

3.1. WAGE INCOME

Before discussing the patterns of wage inequality revealed by the estimates in Tables 2.1–2.4, we ought to comment on the reliability of our estimator. Although there are no previous estimates of Gini coefficients for Soviet wage distributions with which we can compare our results, one measure of the general performance of the estimator is to examine how well it determined the mean and minimum of the wage distribution.

As far as the *mean* wage is concerned, our estimator seems to have performed quite well. (See Table 2.1: the mean wages listed for estimate (4) are those officially reported in Soviet sources; the means in estimate (2) were produced by our estimator.) For the years 1956, 1968, and 1972, our estimates of the mean are almost identical to the published Soviet data on the average annual wage. The estimates for the other years diverge slightly from the reported figure; nevertheless, the widest discrepancy between our estimate and the reported average wage for any year was less than 4%.

The estimator's calculation of the *minimum* wages, however, is significantly different from what we assumed to be the actual minimum wages in the USSR for the appropriate years. (The minima in estimate (3) of Table 2.1 were generated by our estimator; the minima in estimate (4) are what we presume to be the actual minima, based on the reasoning presented in Note 3 of the Appendix.) The discrepancy here may not be due to to any shortcomings of the estimator; it is also possible that we simply made the wrong assumption about the minimum wage in the Soviet Union. However, we could find no compelling argument to abandon our assumption about the actual minimum Soviet wage, and consequently, we decided that the most reliable wage distribution estimates are those that use exogenously determined mean wages and minimum wages, that is, estimate (4) in Table 2.1. This set of estimates, repeated below in Table 3.1 for reference, is the one on which we base our discussion in the following.

TABLE 3.1 Gini Coefficients Based on Wage Size Distribution, USSR 1956–1986

	Gini Coefficient
1956	.177
1968	.224
1972	.228
1976	.226
1981	.217
1986	.233

Recall that a higher Gini coefficient reflects a relatively higher degree of inequality. Hence, a comparison of the figures for 1956 with those of 1986 would seem to imply a sharp increase in the inequality of wage earnings over this 30–year period: the Gini coefficient in 1986 was over 30% greater than in 1956. However, closer inspection of the underlying data cautions against such a conclusion. In the wage distribution data for 1956 (see Table 1.1), over 70% of wage–earners fall into the "Under 80 rubles" category. Without any more information about how such a large percentage of wage–earners were distributed within that interval, any judgment about overall wage inequality in that period is highly unreliable, and we will not make any claims about 1956. The data for the period of 1968 and later do seem more reliable and may permit some tentative conclusions about the trends since 1968. 1968–1976 appears as a period of stability as far as wage equality is concerned. Wage inequality then dropped slightly in the later Brezhnev years (1976–1981). During the first half of the 1980s, on the other hand, there seems to have been a renewed trend toward increased inequality. These patterns can be seen more clearly from Table 3.2, which shows the percentage change in the Gini coefficient over the years 1968–1986.

TABLE 3.2 Percentage Change in the Gini Coefficient Based on Wage Size Distribution, USSR 1968–1986

	Change in Gini
1968–1976	+1%
1976–1981	–4%
1981–1986	+7%

3.2. (LEGAL) HOUSEHOLD INCOME PER CAPITA

It is perhaps more interesting to apply our methodology to per capita income from all sources.[13] The size distribution of per capita income in the Soviet Union is less well known than the size distribution of wages. On the surface, it is difficult to predict what the size distribution of per capita income looks like, knowing only the picture of wage distribution, in part because of the confusion of statistical data. Soviet wage data include only state–sector workers and employees, and thus exclude collective farmers and pensioners. Official income data, on the other hand, do include these latter groups. And in addition to state wages, "total income"

[13] This section refers to those sources of income which are likely to be reflected in the Soviet surveys used as a basis for the Soviet income distribution data discussed in this section. Clearly, these surveys do not include income obtained illegally. We will discuss the adjustment for illegal incomes in Section 5.

includes legal private income (mainly income from private plots), state transfer payments, and private transfer payments.[14]

In sum, only an examination of the data can answer the question of relative income inequality. Table 3.4 presents the officially reported mean incomes and our estimated Gini coefficients for per capita incomes in the USSR for 1980, 1985, and 1988 (from estimate (2) of Table 2.3).

TABLE 3.4 Reported Means and Estimated Gini Coefficients for USSR per Capita Income—1980, 1985, 1988

	Mean	Gini
1980	112	.146
1985	127	.146
1988	147	.146

SOURCE: Estimate (2) of Table 2.3.

Table 3.4 shows that although mean income levels rose in the 1980s (about 13% from 1980 to 1988), income inequality remained stable in this period. This is in contrast to the trend we observed for wage inequality, where inequality appeared to have grown in the 1980s (in a period when wages and total incomes were growing at about the same rate).

One very interesting issue is whether total income is distributed more or less equally than wages in the Soviet Union. MCAULEY [1979] concluded that inequality of per capita incomes does not differ significantly from inequality of wages and salaries.[15] The much lower Gini which we obtain for income distribution as opposed to wage distribution might at first glance seem to suggest that income is more evenly distributed than wages in the Soviet Union. We have to caution against drawing such a conclusion, however. Unfortunately, comparing Gini coefficients which have been estimated from grouped data—the sort of data we are using here—is not a straightforward matter. It is only in the case when the comparison figures use the same intervals that one can validly make any such comparisons.

[14] The total income figures also take into account income taxes. However, we would not expect income taxes in the Soviet Union to have a major effect on income distribution, since the tax is very modest and only mildly progressive.

[15] Note, however, that McAuley's argument was based on a comparison of decile ratios rather than Gini coefficients.

4. INTRA-REPUBLICAN WAGE AND INCOME INEQUALITY

At a time of increasing tensions among Soviet nationalities and a growing movement towards republican autonomy and even independence, the publication of official data on income distribution broken down by republic is particularly valuable to researchers studying the Soviet economy. As we shall demonstrate below, these data reveal some interesting regularities in the regional pattern of income distribution.

4.1. WAGE INCOME

In Section 3.1 above, we concluded that wage inequality in the Soviet Union as a whole has remained relatively stable since 1968, with a slight increase in inequality in the 1980s. The present section investigates what has been happening at the republican level. Which republics show greater and which less equality, and have there been noticeable changes over time? Since wage rates in the USSR are regulated by the central government, we might expect that if wage equality has been a goal at the national level, the same would apply for the republics. In other words, we could expect that the distribution of wage income would be relatively uniform across different republics. This does not seem to be the case, however. Consider the measures of wage inequality for the Soviet republics in 1981 and 1986 presented in Table 4.1.

TABLE 4.1 Gini Coefficients Based on Wage Size Distribution, USSR and Republics, 1981 and 1986

	1981	1986
	Gini	Gini
USSR	.217	.228
RSFSR	.207	.221
Ukraine	.214	.233
Belorussia	.197	.219
Uzbekistan	.245	.256
Kazakhstan	.240	.254
Georgia	.238	.273
Azerbaijan	.258	.280
Lithuania	.200	.209
Moldavia	.212	.240
Latvia	.205	.221
Kirgizia	.228	.254
Tadzhikistan	.226	.256
Armenia	.240	.251
Turkmenistan	.212	.238
Estonia	.200	.207

SOURCE: Estimate (2) of Table 2.2.

Table 4.1 reveals two distinct patterns for wage inequality. First, during 1981–1986, wage inequality as measured by the Gini coefficients increased in every Soviet republic. The largest percentage increases in inequality during 1981–1986 occurred in Georgia, Moldavia, Tadzhikistan, and Turkmenistan.[16] Second, the Gini coefficients for the northern (Slavic and Baltic) republics are lower than those of the southern (Transcaucasian and Central Asian) republics. (The sole exception is that the Gini coefficient for Turkmenistan in 1981 is slightly lower than that for the Ukraine). Moreover, these North–South differences seemed to have become more pronounced in 1986 as compared to 1981.

One further question that might be answered by our data is the extent to which equality among the citizens of a republic is related to their wealth. In other words, is the size distribution of wages more egalitarian in high–wage republics or low–wage republics? If we measure inequality by the Gini coefficient, we find a clear answer: the higher the mean wage in a republic, the lower the level of wage inequality. Table 4.2 shows how the republics were ranked in 1986 according to mean wage

[16] Some of these increases were rather small and may not be statistically significant (e.g., Lithuania and Estonia), but the pattern is unmistakeable.

and Gini coefficient. The positive correlation between these two rankings is statistically significant.[17]

TABLE 4.2 Republics Ranked by Mean Monthly Wage Earnings and Gini Coefficient for Wages, 1986

Ranking by Mean Monthly Wage			Ranking by Gini Coefficient		
1	Moldavia	160.6	1	Azerbaijan	.280
2	Tadzhikistan	160.8	2	Georgia	.273
3	Azerbaijan	162.0	3	Tadzhikistan	.256
4	Kirgizia	165.3		Uzbekstan	.256
5	Uzbekistan	165.4	5	Kazakhstan	.254
6	Georgia	169.7		Kirgizia	.254
7	Ukraine	177.5	7	Armenia	.251
8	Belorussia	178.5	8	Moldavia	.240
9	Armenia	183.3	9	Turkmenistan	.238
10	Kazakhstan	190.9	10	Ukraine	.233
11	Turkmenistan	192.5	11	Latvia	.221
12	Lithuania	193.3		RSFSR	.221
13	Latvia	199.8	13	Belorussia	.219
14	RSFSR	205.9	14	Lithuania	.209
15	Estonia	219.3	15	Estonia	.207

SOURCE: Estimate (2), 1986 panel, of Table 2.2.

4.2. (LEGAL) HOUSEHOLD INCOME PER CAPITA[18]

The set of data which contains the most new information on Soviet income distribution is the 1988 distribution of per capita income from all sources broken down by republic (Table 1.4). To the best of our knowledge, nothing of the kind has been released by the Soviets since the late 1920s. Even the data on *means* of per capita incomes by republic have not been available to Western researchers. By fitting these data to a lognormal distribution, we are able to estimate both Gini coefficients and mean incomes by republic. Our results are shown in the first two columns of Table 4.3 below.

[17] The Spearman rank correlation statistic between the rankings by mean wage and Gini coefficient in Table 4.2 is +0.72. The critical value of the statistic for a two-tail test with $\alpha = .05$ and $n = 15$ is .525.

[18] As mentioned in footnote 13, "total income" does not include income obtained illegally. The adjustment for illegal incomes is discussed in Section 5.

TABLE 4.3 Republics Ranked by Mean per Capita Income (Rubles per Month), Gini Coefficient for Income, and Family Size, 1988

Ranking by Mean Income			Ranking by Gini Coefficient			Ranking by Family size		
1	Tadzhikistan	78	1	Azerbaijan	.159	1	Tadzhikistan	6.0
2	Uzbekistan	91		Tadzhikistan	.159	2	Turkmenistan	5.8
3	Kirgizia	101		Turkmenistan	.159	3	Uzbekistan	5.7
4	Turkmenistan	102	4	Georgia	.157	4	Azerbaijan	5.1
5	Azerbaijan	107		Kirgizia	.157	5	Kirgizia	4.6
6	Armenia	125	6	Uzbekistan	.154	6	Armenia	4.4
7	Moldavia	132	7	Kazakhstan	.146	7	Georgia	3.9
8	Kazakhstan	134	8	Armenia	.141		Kazakhstan	3.9
9	Georgia	141	9	Estonia	.138	9	Lithuania	3.2
10	Ukraine	142	10	Moldavia	.133		Ukraine	3.2
11	Belorussia	156		RSFSR	.133	11	RSFSR	3.1
12	RSFSR	160	12	Latvia	.125	12	Estonia	3.1
13	Lithuania	165		Ukraine	.125	13	Belorussia	3.0
14	Latvia	174	14	Belorussia	.122	14	Latvia	3.0
15	Estonia	186		Lithuania	.122	15	Moldavia	3.0

SOURCE: Mean and Gini coefficient from Table 2.4, estimate (2). Family size is a linear extrapolation to 1988 of the 1970–1979 trend reported in *Naseleniye SSSR* [1987], p. 109.

Table 4.3 shows that although the republican rankings according to average per capita income are generally the same as the rankings by average wage (Table 4.2), there are some differences. For example, Russia ranks second after Estonia in average wages, but it lags behind all three Baltic republics in per capita income. Turkmenistan, on the other hand, had the fifth highest average wage, but is close to the bottom of the per capita income rankings. In general, the Baltic republics have the highest per capita incomes, the Slavic republics are second, and the Central Asian republics are a distant last. Table 4.3 also suggests that, as in the case of wages, higher income in a republic is associated with greater equality.

The third column of Table 4.3—ranking of republics by average family size—introduces an additional factor into the discussion of income distribution. It is evident from all three rankings in the Table that there is a positive association between low mean income, inequality as measured by the Gini coefficient, and large family size.[19] This means that the fact that the republics with the lowest mean wages also tend to have the largest families (the major exception is Moldavia) further widens the gap between republics when we compare per capita incomes rather than wages. While the ratio of the highest to lowest average republican wage

[19] The Spearman rank correlation coefficient between the rankings in Table 4.3 by mean income and Gini coefficient is +0.76, between mean income and family size +0.80, and between Gini coefficient and family size is +0.82.

was only 1.37 (Estonia's 219.3 to Moldavia's 160.6), the ratio of highest to lowest per capita income rises to 2.38 (Estonia at 186 compared to Tadzhikistan at 78).[20]

5. ADJUSTMENTS FOR ILLEGAL INCOME

So far, this paper has identified two main trends in Soviet wage and income distribution which emerge from the official statistics. First of all, wage inequality has increased over time in all areas of the USSR, and second, both wage and income inequality are clearly greater in the Soviet South than in the North. In this section, we will examine the impact of the illegal part of the so–called second economy on the patterns of income inequality in the Soviet economy.[21]

Precise estimates of the size of illegal incomes in the USSR are, for obvious reasons, not possible to obtain. Research based on the Berkeley–Duke survey of emigres from the Soviet Union indicates that the second economy accounts for over a third of the urban population's income [GROSSMAN 1987].[22] Soviet estimates of the annual turnover in the illegal part of the second economy in the late 1980s range from a conservative Goskomstat estimate of 56.5 billion rubles to a high of 350 billion rubles, with most estimates falling between 100 and 200 billion rubles [*Sotsial'noye...* 1990, p. 121; KORYAGINA 1990; GOLOVNIN and SHOKHIN 1990, p. 51; BINEYEV 1989, p. 5]. By far the largest part of the second economy income is obtained illegally.

It has been suggested that the opportunities for illegal earnings in various jobs in the Soviet economy are inversely correlated with official pay in those jobs.[23] In other words, illegal earnings serve as a kind of equilibrating mechanism to compensate for the distorted administered wages. However, this does not

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[20] Although we raise the issue of family size, we do not discuss here the difficulty of comparisons of real income across households of differing sizes and compositions. This is the basis of the debate on so–called equivalence scales. DEATON and MUELLBAUER [1980, Chapter 8] point out that comparing per capita budget levels is fraught with problems. For example, they note that a comparison of per capita income ignores "the variation of need with age: babies need less than adults. Also there are likely to be opportunities for economies of scale in consumption. Three people do not need proportionately more bathrooms or cars than two people; buying or cooking food in bulk is cheaper; clothes can be handed down from older to younger children" [p. 192].

[21] The Soviet second economy is sometimes deemed to correspond to what in the West is known as the underground economy or informal economy. The Soviets themselves most frequently use the term "shadow economy." In this work, we follow the more precise definition offered by Gregory GROSSMAN [1979]: the Soviet second economy includes all economic activities which are either performed directly for private gain, or are illegal, or both.

[22] The data set assembled by the Berkeley–Duke Project on the Second Economy in the USSR is based on an extensive questionnaire administered to members of over 1000 families which had emigrated to the United States from the Soviet Union in the late 1970s and early 1980s. It is particularly important to note for this study that the conditions reported by the survey participants relate to the late 1970s and that nearly all the participants were from urban areas of the Soviet Union.

[23] The first clear statement of this hypothesis was in GROSSMAN [1979]. See also TREML [1990a] and GADDY [1991] for two different approaches to empirically testing the hypothesis.

necessarily imply that illegal income reduces inequality. If illegal income is large and if its variance is greater than that of legal income, illegal earnings may actually exacerbate the inequality. BERGSON [1984] is of the opinion that the inclusion of private (legal and illegal) income leads to increased income inequality. The Berkeley–Duke survey provides an opportunity to evaluate this conjecture. Although the measures of income inequality based on this survey are not directly comparable to those calculated from the official data, we believe that the pattern of changes in these measures brought about by inclusion of illegal earnings are valid for the Soviet population at large.

Table 5.1 compares the Gini coefficients based on legal income and income from all sources (legal and illegal) for the Southern and Northern subsamples of the Berkeley–Duke survey.[24]

TABLE 5.1 Gini Coefficients from the Berkeley–Duke Survey

	Gini Coefficients	
Region	Official Income	Total Income
North (N=637)	0.29	0.30
South (N=317)	0.30	0.37

SOURCE: "Official Income" includes all officially sanctioned sources of income in the USSR. "Total Income" includes illegal second economy income.

As the Table indicates, for the Northern subsample the inclusion of illegal income has virtually no effect on the Gini coefficient derived from legal income alone. In the South, on the other hand, illegal income appears to substantially raise inequality. This pattern of differences between North and South is consistent with the hypothesis that greater second economy activity is associated with greater inequality since, as other work on the Berkeley–Duke survey has shown, there is a much higher level of second economy activity—legal and illegal—in the Soviet South than in the North.

The data in Table 5.1 relate to the late 1970s. Since that time the second economy has been growing by leaps and bounds.[25] If it is true that a larger second economy means more inequality, then the expected result of the past decade's growth in the underground economy would be an exacerbation of income inequality in the USSR as a whole. In other words, the estimates of household income inequality for the mid–1980s which we derived from the official Soviet data should

[24] The Southern subsample consists of sample participants who resided in the Transcaucasus and Central Asian republics of the USSR. The Northern subsample represents participants from the RSFSR, Belorussia, the Ukraine, Moldavia, and the Baltic republics.

[25] One of the leading Soviet experts on the second economy, Tatyana Koryagina, has for instance estimated that the illegal second economy has grown approximately four-fold over the last 15–20 years. (See her interview in *Trud*, August 12, 1988, p. 4.)

be adjusted upwards. Also, we can assume that the inclusion of illegal income would make the already relatively unequal income distribution in the Southern republics even more pronounced.

In sum, we conclude that when we take into consideration the additional factor of the second economy, a factor largely ignored in the official income statistics, we corroborate our original finding that the Soviet South displays greater income inequality than the North and that income inequality in the Soviet Union has grown during the Gorbachev period.

APPENDIX

NOTE 1. THE GOSKOMSTAT FAMILY BUDGET SURVEY

The Goskomstat family income and distribution data, which are derived from a sample of 92,000 families, have long been the subject of criticism by Western specialists. SHENFIELD [1983], for instance, argues that the sample used by Goskomstat is not truly representative because the selection is heavily weighted in favor of families of workers who are employed in heavy industry and who reside in the larger urban areas—those whom Soviet statisticians consider representative of the "core" of the labor force. Once selected and trained in record–keeping, the family is retained for several years, thus perpetuating the bias.

TREML [1990b] has conclusively demonstrated the unrepresentativeness of the Goskomstat household survey by comparing the survey data on income and expenditures with other official figures on these same items. We reproduce Treml's calculations in Table A.1 on the facing page.

Column (1) of Table A.1 is reproduced from official Goskomstat data covering the total family budget sample, i.e., workers and employees, kolkhozniks, and pensioners. The second column translates the percentages recorded in the first column into absolute rubles on the basis of the official figure of the average per capita 1988 money income of 143 rubles per month and the 1988 population of the Soviet Union, or 285.5 million. In other words, total income = 143 rubles x 12 months x 285.5 million people = 489.9 billion rubles. The third column records three elements of personal money income and two elements of personal money expenditures derived from official statistics unrelated to Goskomstat's household surveys. If the sample of 92,000 households used in the survey were representative, the absolute ruble figures in the second and third columns of the table would be identical. They do not agree, however, and in some cases the discrepancies are quite substantial. In fact, the signs of the differences (+ or –) suggest that the Goskomstat survey is not merely unrepresentative but that it is systematically biased. The survey–derived total wages and salaries, kolkhoz pay, taxes, and savings are higher than the independent control totals, while state transfer payments such as pensions and aid are lower. This means that the sample used in the household survey excludes a certain, probably a significant, share of poor families with lower than average earnings and taxes, and higher than average aid from the state. (In all probability the sample also excludes a number of well–to–do households. However, their number is sufficiently small to make the average income of excluded families lower than the overall mean income reported.)

TABLE A.1 Total 1988 Money Income of Soviet Population
(Billions of current rubles, except column (1), which is in percent)

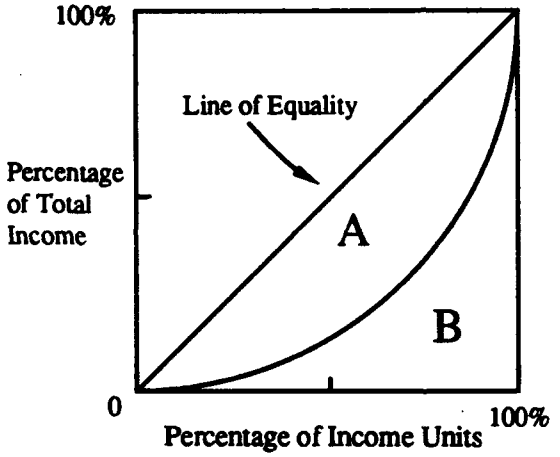
	(1) Budget shares in percent (surveys)	(2) Total income and expenditures (surveys)	(3) Control Totals (independent)	(4) Difference between (2) and (3)
TOTAL INCOME	100.0	489.9		
State wages and salaries	65.4	320.4	309.2	+11.2
Kolkhoz pay	6.6	32.3	25.8	+6.5
State transfers (pensions, aid, and student stipends)	13.6	66.6	76.4	–9.8
Private agriculture	6.8	33.3		
Other income and private transfers	7.6	37.2		
TOTAL EXPENDITURES	100.0	489.9		
Food	34.3	168.0		
Nonfood goods	30.4	148.9		
Services	9.6	47.0		
Taxes and dues	8.1	39.7	35.9	+3.8
Other expenditures	8.8	43.1		
Savings	8.8	43.1	31.8	+11.3

SOURCES AND NOTES: Columns (1) and (2) are from *Ekonomicheskaya gazeta*, No. 25 (June) 1989, p. 11. Column (3): Wage, employment, kolkhoz payments, taxes and dues, and bank savings are from *Narkhoz 1988* [1989, pp. 34, 77, 83, 96, 512, and 624].

The five figures shown in column (3) of the table vary in accuracy. Kolkhoz pay, state transfers, and taxes and dues are taken directly from Soviet sources and are accurate. The wage and salary figure is accurate as derived. We do not know, however, how wages and salaries are defined in household surveys. It is possible that they include military pay. The CIA estimated total military pay and monetary allowances at a constant 8 billion rubles between 1982 and 1987 (CIA [1989, p. 11]), and we can assume that the 1988 figure would be the same. Military pay alone would probably account for about one-half of the total and thus, if military pay is included in the Goskomstat budget data, the total given above for "State wages and salaries" in column (3) should be adjusted upward by about 4 billion rubles. The least reliable figure in column (3) is the figure for savings. The Goskomstat figure includes the net change in cash holdings and in savings accounts and bond purchases, while the control total excludes changes in cash. The latter could be anywhere from a couple to ten billion rubles; so we know that the figure in column (3) is understated. These possible errors would not affect the main conclusion reached in this Note, as the direction (+ or –) of discrepancies between figures in columns (2) and (3) would remain the same.

NOTE 2. COMPUTATION OF THE GINI COEFFICIENT

The Gini index of concentration, or the Gini coefficient, is a measure of income concentration usually defined in terms of the Lorenz curve. The Lorenz curve is obtained by plotting the cumulative percentage of income units (households or individuals) on the X axis against the cumulative percentage of aggregate income accounted for by those units on the Y axis. The axes and a typical Lorenz curve are shown in the figure below.



If all units had exactly the same incomes, the plot would be the diagonal labeled "Line of Equality." If there is any inequality at all, however, the Lorenz curve lies below the line of equality. This means that the poorest x % of the population earns less than x % of total income for some x.

The Gini coefficient is the proportion of the total area under the diagonal which is between the diagonal and the Lorenz curve. Using the notation in the figure, the Gini coefficient could then be written:

$$\text{Gini} = \frac{A}{A+B} = \frac{\text{area between curve and diagonal}}{\text{area under diagonal}}$$

NOTE 3. MINIMUM KOLMOGOROV–SMIRNOV ESTIMATOR

The minimum Kolmogorov–Smirnov estimator is based on the Kolmogorov–Smirnov one-sample test. That test measures goodness–of–fit between the distribution of a set of sample values (in our case, the observed distribution of wage earnings or income) and a specified theoretical distribution (here, the lognormal) by comparing their cumulative frequency distributions. The Kolmogorov–Smirnov statistic finds the point of greatest divergence between the two. SIEGEL and CASTELLAN [1988] provide a detailed description of the Kolmogorov–Smirnov statistic and its properties.

The Kolmogorov–Smirnov statistic can be formally described as follows. Let F(X) be the theoretical cumulative relative frequency distribution function. For any value of X (any income point) the value of $F(X_i)$ is the proportion of wage-earners *expected* to have a monthly income less than or equal to X_i.

Let S(X) be the observed cumulative relative frequency distribution of a sample. $S(X_i)$ will be the *observed* proportion of observations less than or equal to X_i.

If the sample has indeed been generated by the specified theoretical distribution function, we would expect that the value of the theoretical distribution, $F(X_i)$, would be close to the observed $S(X_i)$. The differences at each point, $F(X_i) - S(X_i)$, should be small for all X_i, within the limit of random error.

The Kolmogorov–Smirnov test looks at the *largest* of these deviations between the sample distribution and the theoretical distribution, a magnitude which we can label D. In other words,

$$D = \max |F(X_i) - S(X_i)|$$

The Kolmogorov–Smirnov estimator finds the parameters of the theoretical distribution which best fits the observed sample, where "best" is defined as the theoretical distribution yielding the smallest D when compared to the observed data. In our case, the estimation problem can be expressed

$$\min D = \min \{\max | \Lambda (\mu, \sigma; X_i) - S(X_i)|\} \text{ w.r.t. } \mu, \sigma$$

where μ is the mean and σ is the standard deviation of the lognormal distribution Λ. The problem was solved using iterative methods.

NOTE 4. AVERAGE ANNUAL EARNINGS

The official Soviet statistical handbook, *Narodnoye khozyaystvo SSSR v 19XX godu* (or *Narkhoz*) has the average monthly monetary earnings [*srednemesyachnaya denezhnaya zarabotnaya plata*] for workers and employees for each year (see, e.g., *Narkhoz 1986*, p. 434). We adjusted this figure to March or April for each year, so as to correspond to the reporting date for the data presented in the handbook of labor statistics, *Trud v SSSR*, on distribution of wage earnings. CHAPMAN (1976, pp. 263-264) points out that the data for these two wage series—

Narkhoz's annual average and the March/April wage censuses—differ slightly. In general, the figure we obtained on the basis of *Narkhoz* is probably higher than would be obtained from the March census data. However, there seems to be no way to reliably correct for this discrepancy, and we thus took the *Narkhoz* figures, adjusted only for the month, as the mean.

NOTE 5. THE MINIMUM LEGAL WAGE AND MINIMUM INCOME

Trud v SSSR [1988, pp. 225-229] discusses the history of minimum-wage legislation in the USSR. In brief, the legal minimum wage (in rubles/month) following major revisions was as follows:

Jan. 1, 1957: 27–35
Jan. 1, 1965: 40–45
Jan. 1, 1968: 60
Jan. 1, 1977: 70

The wage earnings series we have for estimation are for 1956, 1968, 1972, 1976, 1981, and 1986. Strict application of the legal minimum wage to these years would dictate the following minima (rubles/month):

1956: under 27
1968: 60
1972: 60
1976: 60
1981: 70
1986: 70

However, there are problems with these levels. As discussed in CHAPMAN [1979], it is unlikely that the raising of the legal minimum wage would have an immediate and total effect. To account for a lag in the effects of wage–setting practice, we therefore assumed the actual minima to be as follows (rubles/month):

1956: 17
1968: 54
1972: 56
1976: 58
1981: 64.5
1986: 70

For per capita total income, there are no official laws to go by. Consequently, we made the following assumption. We took minimum per capita income to be the actual minimum wage arrived at above and divided by 5. The assumption here is that the minimum per capita total income would be found in a family in which total income comes from only one wage-earner, who earns the minimum wage and who has a non–working spouse and three children all over the age of 8 years. (Any children under 8 years would entitle the family to state benefits to low–income families with children; having more than three children of any age entitles the family

to child support benefits. We assume, following the results of GREGORY and COLLIER [1988], that long–term unemployment was negligible.) Interpolation and extrapolation of the minimum wage series above to obtain figures for 1980, 1985, and 1988 and division by 5 yields the following minimum per capita incomes (rubles/month):

1980:	12.6
1985:	13.8
1988:	14.4

The same minimum was used for the USSR and all republics for both wage and income.

NOTE 6. WAGE INEQUALITY BY AGE AND SEX

In *SSSR v tsifrakh v 1989 godu* [*The USSR in Figures in 1989*], Goskomstat provided figures on distribution of wages by age and by sex similar to those in the body of this paper for the USSR in various years and for the republics. Although a detailed discussion of wage inequality by age and sex lies outside the scope of this paper, the Kolmogorov–Smirnov estimator employed in this paper can be used to compute means and Gini coefficients. Table A.2 presents the original data from the Soviet source. Table A.3 presents the summary statistics derived from those original data. (When interpreting these data, the reader must keep in mind that we are talking about wages of full–time workers and employees. The results, therefore, do not take into account a likely possibility that more women than men work only part–time.)

Neither the means nor the distributional patterns of wages by sex and within different age groups have been previously reported by the Soviets or even estimated by Western scholars. The data presented in Table A.3 contain two main qualitative results. First, while wage equality in the youngest cohort (16–24 years) appears to be about the same for males and females, females show substantially greater wage inequality than do males in the cohorts aged 25 and over. Moreover, while for males the inequality declines with age until the age of 50, for females it changes very little. For both sexes, there is a substantial increase in inequality for the "50+" age group compared to the 40–49 age group. The second result concerns the general pattern of change of average wages with age: both men and women show an increase in average wages until around 40–49 years of age and then a decline in the 50+ group. The figures in Table A.3 indicate a ratio of female–to–male wages ranging from 68% to 76%. The ratio drops to its lowest point in the prime child–bearing years (25–39) and climbs thereafter. The fact that the female–male wage ratio is highest of all in the 50+ cohorts (nearly 76%) may be due in part to the fact that the comparison groups differ between men and women: for women, normal working age ends at age 55, while for men it extends to age 60. Hence, the ratio in question is actually comparing the mean wages of a younger group of women to those of older men.

TABLE A.2 Distribution of Soviet Full-Time Workers and Employees in Various Age Groups, by Wage Levels, March 1989 (% in each earnings interval)

MEN

Rubles earned per month	Years of Age 16–24	25–29	30–39	40–49	50+
Under 80	4.1	1.4	0.8	0.8	2.4
80-90	4.5	2.1	1.3	1.2	2.9
91-100	4.9	2.2	1.3	1.2	2.3
101-120	10.0	5.7	3.7	3.3	5.6
121-140	9.5	6.8	4.5	4.1	6.1
141-160	12.5	10.1	7.1	6.4	8.5
161-180	11.3	10.7	8.9	8.2	10.9
181-200	10.2	10.5	10.0	10.0	10.1
201–220	6.4	8.0	8.2	8.1	7.6
221–250	8.3	11.2	12.7	13.3	11.5
251–300	8.5	12.4	15.7	16.6	13.4
301–350	4.2	6.9	9.2	10.0	7.8
351–400	2.4	4.4	5.9	6.1	4.3
Over 400	3.2	7.6	10.7	10.7	6.6

WOMEN

Rubles earned per month	Years of Age 16–24	25–29	30–39	40–49	50+
Under 80	6.7	3.5	2.6	2.9	6.3
80-90	13.9	8.5	5.8	5.4	9.1
91-100	9.5	6.9	4.8	4.2	5.7
101-120	18.9	15.3	11.5	10.2	12.2
121-140	14.1	14.5	12.1	10.0	10.5
141-160	12.3	14.1	13.2	11.9	11.2
161-180	7.7	10.6	11.5	11.4	10.8
181-200	5.6	7.6	9.5	9.6	8.1
201–220	3.4	5.0	6.6	7.1	5.9
221–250	3.4	5.5	7.8	9.0	7.1
251–300	2.7	4.7	7.4	9.2	6.9
301–350	1.0	1.9	3.4	4.2	3.1
351–400	0.4	0.9	1.7	2.2	1.5
Over 400	0.4	1.0	2.1	2.7	1.6

SOURCE: *SSSR v tsifrakh v 1989 godu*, pp. 71–72.

TABLE A.3 Estimates of Mean Monthly Wages and Gini Coefficients for Soviet Men and Women of Various Age Groups—1989

	MEN		WOMEN		
Age in Years	Gini	Mean (R/mo.)	Gini	Mean (R/mo.)	Female wage as % of male
16–24	.212	229	.214	163	71.2%
25–29	.187	270	.200	184	68.1%
30–39	.172	304	.202	212	69.7%
40–49	.167	308	.205	224	72.7%
50+	.195	270	.233	205	75.9%

NOTE: A lognormal curve was fitted to the data in Table A.2 by a minimum Kolmogorov-Smirnov estimator.

REFERENCES

AITCHISON, J. and BROWN, J.A.C. *The Lognormal Distribution, with Special Reference to Its Uses in Economics*. Cambridge: Cambridge University Press, 1957.

ALEXEEV, Michael. "The Effect of Housing Allocation on Social Inequality: A Soviet Perspective." *Journal of Comparative Economics*, 12:2, 228–234, 1988.

_____. "Distribution of Housing Subsidies in the USSR with Some Soviet–Hungarian Comparisons." *Comparative Economic Studies*, forthcoming, 1990a.

_____. "Retail Price Reform and the Soviet Consumer," in John Tedstrom, ed., *Socialism, Perestroika & the Dilemmas of Soviet Economic Reform*. Boulder, Colorado: Westview Press, forthcoming, 1990b.

ALLISON, Paul D. "Measures of Inequality." *American Sociological Review*, 43:6 (December), 865–880, 1978.

ATKINSON, Anthony B. "On the Measurement of Inequality." *Journal of Economic Theory*, 2:244–263, 1970.

BERGSON, Abram. "Income Inequality Under Soviet Socialism." *Journal of Economic Literature*, 22:3 (September), 1052–1099, 1984.

BINEYEV, A. "Vykhodit iz teni." *Argumenty i fakty*, 37:5, 1989.

CHAPMAN, Janet. "Soviet Wages under Socialism," in Alan Abouchar, ed., *The Socialist Price Mechanism*. Durham, NC: Duke University Press, 1977.

_____. "Income Distribution and Social Justice in the Soviet Union," *Comparative Economic Studies*, 31:1 (Spring), 14–45, 1989.

CIA. *USSR: Estimates of Personal Income and Savings*, (SOV 89–10035). Washington, D.C.: 1989.

DEATON, Angus and MUELLBAUER, John. *Economics and Consumer Behavior*. Cambridge: Cambridge University Press, 1980.

GADDY, Clifford G. "Pretending to Work and Pretending to Pay: A Hedonic Wage Approach to the Behavior of Soviet Workers and Managers." In "The Labor Market and the Second Economy in the Soviet Union." *Berkeley–Duke Occasional Papers on the Second Economy in the USSR*, No. 24, January 1991.

GOLOVNIN, S.D. and SHOKHIN, A.N. "Tenevaya ekonomika: za realizm otsenok." *Kommunist*, 1:51–57, 1990.

Goskomstat. *Prospekt izdaniy sbornikov, operativnykh statisticheskikh materialov, nauchno–tekhnicheskoy informatsii na 1990 god*. Moscow: 1990.

GREGORY, Paul R. and COLLIER, Irwin L., Jr. "Unemployment in the Soviet Union: Evidence from the Soviet Interview Project." *American Economic Review* 78:4 (September), 613–632, 1988.

GROSSMAN, Gregory. "Notes on the Illegal Private Economy and Corruption." In Joint Economic Committee, US Congress, *Soviet Economy in a Time of Change*, Volume 1, pp. 834–856. Washington, DC: US Government Printing Office, 1979.

_____. "Roots of Gorbachev's Problems: Private Income and Outlay in the Late 1970s." In Joint Economic Committee, US Congress, *Gorbachev's Economic Plans*, Volume 1, pp. 213–230. Washington, DC: US Government Printing Office, 1987.

Kapital'noye stroitel'stvo SSSR. Statisticheskiy sbornik. Moscow: Finansy i statistika, 1988.

KORYAGINA, T. "Tenevaya ekonomika." *Trud*, August 12, p. 4, 1988.

_____. "Tenevaya ekonomika v SSSR (analiz, otsenki, prognozy)." *Voprosy ekonomiki*, no. 3, 110–120, 1990.

MATTHEWS, Mervyn. *Privilege in the Soviet Union: A Study of Elite Life-Styles under Communism*. London: G. Allen & Unwin, 1978.

MCAULEY, Alastair. *Economic Welfare in the Soviet Union*. Madison, Wisconsin: University of Wisconsin Press, 1979.

MCDONALD, James and RANSOM, Michael R. "Functional Forms, Estimation Techniques and the Distribution of Income." *Econometrica*, 47:6 (November), 1513–1525, 1979.

Narkhoz [*Narodnoye khozyaystvo v SSSR v 19XX godu*], various years.

Naseleniye SSSR 1987. Moscow: Finansy i statistika, 1988.

RUTGAYZER, V.M., SHMAROV, A.I. and KIRICHENKO, N.V. "Reforma roznichnykh tsen, mekhanizm kompensatsii i razvitiye potrebitel'skogo rynka." *EKO*, No. 3 (March), 58–70, 1989.

SHENFIELD, Stephen. "A Note on Data Quality in the Soviet Family Budget Survey." *Soviet Studies*, 35:4 (October), 561–568, 1983.

SIEGEL, Sidney and CASTELLAN, N. John Jr. *Nonparametric Statistics for the Behavioral Sciences*. 2nd edition. New York: McGraw–Hill, 1988.

Sotsial'noye razvitiye i uroven' zhizni naseleniya SSSR. Statisticheskiy sbornik. Moscow: Finansy i statistika, 1989.

SSSR v tsifrakh v 1989 godu. Moscow: Finansy i statistika, 1990.

TREML, V. G. "Study of Employee Theft from Places of Employment." *Berkeley–Duke Occasional Papers on the Second Economy in the USSR*, No. 20, June, 1990a.

_____. "Note on the Unrepresentativeness of the Goskomstat Household Budget Survey." Unpublished research memorandum for the Berkeley–Duke Project on the Second Economy in the USSR. Duke University, Department of Economics, Durham, NC, 1990b.

Trud v SSSR. Moscow: Finansy i statistika, 1988.